CSM-97

Tri-Clover®
C-Series Centrifugal Pump

Models C114 • 216 • 218 • 328 • 4410

Service & Installation Manual

Tri-Clover Inc.

CONTENTS

Thank you for purchasing a Tri-Clover Product!

This manual contains installation, operation, cleaning and repair instructions, with parts lists, for the C-Series close coupled pumps manufactured by Tri-Clover Inc., Kenosha, Wisconsin. It also provides a troubleshooting chart to assist in determining pump malfunction.

READ THIS MANUAL carefully to learn how to service and reconfigure these valves**.** Failure to do so could result in personal injury or equipment damage.

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SAFETY

IMPORTANT SAFETY INFORMATION

Safety is very important!

DO NOT attempt to modify any Tri-Clover product. To do so could create unsafe conditions and void all warranties. ***DO NOT place any Tri-Clover product in an application where general product service ratings are exceeded.***

The following DANGER, WARNING, AND CAUTION signs and their meanings are used within these instructions.

⚠ DANGER

Indicates an imminently hazardous situation which, if not avoided, ***will*** result in death or serious injury. The word Danger is used in the most extreme cases.

⚠ WARNING

Indicates a potentially hazardous situation which, if not avoided, ***may*** result in minor or moderate injury. May also be used to alert against an unsafe operating or maintenance practice.

⚠ CAUTION

Indicates a potentially hazardous situation which, if not avoided, ***could*** result in death or serious injury.

Safety labels are placed on every pump. Do not remove any labeling on any Tri-Clover product. Immediately replace any label that is missing.

Part Number 38-241

INTRODUCTION

DESCRIPTION

⚠ WARNING

Before servicing pump, disconnect electrical power source.

The “C” series close coupled pumps are made up of two sections, power or drive section and the liquid end or pump section.

The pump is mounted to the frame of the drive motor by means of an adapter, and is coupled to the motor shaft by a stainless steel stub shaft. The impeller mounts on the stub shaft and is retained by one of two methods. The casing is clamped to the adapter, greatly simplifying removal, and also permitting positioning of the discharge outlet through 360°. The external, balanced seal assures long seal life. The drive motor is mounted on a frame having adjustable legs providing simple installation and leveling.

INSTALLATION

INSTALLATION GUIDELINES

UNPACKING EQUIPMENT

Check the contents and all wrapping when unpacking your equipment. Inspect all parts for damage that may have occurred during shipping. Report any damage to the carrier.

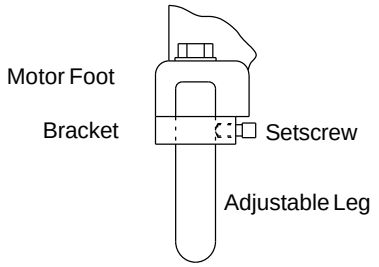
LOCATION AND INSTALLATION

The pump unit should be located as near as possible to the liquid source and in a position where the suction piping can be short and direct with a minimum number of elbows and fittings. It should also be readily accessible for inspection and cleaning.

The pump unit as received from the factory is ready for installation. To install it, attach a hoist if necessary, loosen the setscrews in the adjusting leg brackets, and individually adjust the legs until the pump unit is level. Tighten the setscrews.

Attach the suction and discharge piping. Be sure suction and discharge piping is properly supported to avoid any strain on the pump casing.

Figure One



INSTALLATION

PIPING HINTS

GENERAL

This section provides some do's and don'ts of piping which will aid in obtaining the maximum efficiency and service from your pump.

Piping should be independently supported at both the suction inlet and discharge outlet. Care should be taken that piping is properly aligned and does not put any strain on the pump casing. The piping should have as few bends as possible.

SUCTION PIPING

The suction piping should be short and follow a direct route with a minimum number of elbows and fittings. Elbows should be located as far as possible from the suction inlet to prevent head loss due to increased friction. Excessive friction losses in the suction line could result in pump cavitation, causing poor performance, noise, vibration, damage to equipment, and possible damage to product. Whenever practical the diameter of the piping at the suction inlet should be increased in size. An eccentric tapered reducer should be used in lieu of a concentric tapered reducer to prevent air pockets from forming and impairing pump efficiency. In turn, the eccentric reducer may be placed at the inlet of the pump and should be positioned so the straight side is up.

A horizontal suction pipe must have a gradual rise to the pump. A high point in the suction line will form an air pocket and prevent proper pump operation. All joints in the suction line should be air tight, to prevent air leakage which can reduce pump capacity and efficiency.

DISCHARGE PIPING

Position of the pump discharge is preferably either vertical or top horizontal. The discharge piping should be short and direct with a minimum number of elbows and fittings. Elbows should not be used at the discharge outlet as the friction encountered would be increased, resulting in head loss. It is advisable to increase the pipe diameter at the discharge outlet to prevent head loss. However, use of a larger discharge pipe than recommended may reduce the total pump head, but increase the pump volume, which can cause pump vibration due to overload. Use of a discharge pipe smaller than the pump discharge outlet increases the total pump head but decreases the volume. If a reducer is required on the outlet port of the pump and the discharge is vertical a concentric reducer should be used. If the discharge is horizontal an eccentric reducer should be used and should be positioned so the straight side is down.

LOCATING VALVES

In suction lift applications where the lift is not very high, it may be desirable to install a foot valve, to facilitate priming, and to prevent draining off of the liquid back to the source.

A throttling valve should be installed in the discharge piping to provide a means of throttling pump volume.

MAINTENANCE

TYPE D OR F SEALS EXTERNAL BALANCED

DISASSEMBLY, CLEANING (GENERAL)

⚠ WARNING

Before servicing pump, disconnect electrical power source, carefully relieve all pressure and drain all fluids from pump and connected piping.

It is necessary to disassemble parts of the pump for cleaning and sanitizing. For Tri-Clover pumps equipped with the “Groove-In-Shaft” design (types D, DG, or F seals only), it is not necessary to disassemble if used in Clean-In-Place installation.

The extent of disassembly will depend on the application, and the type of seal used in your pump. To disassemble, disconnect the suction and discharge piping. Remove seal guard assembly with a wrench of appropriate size. Turn the wing nut on the clamp assembly until tension on the clamp saddle is relieved. Open the saddles and remove the casing. At this point the disassembly varies depending on the impeller retaining system applicable to your pump.

For floating retainer models

Push back on the impeller and center the retainer in the stub shaft. Slide the impeller forward and remove it. Do not try to remove retainer before removing impeller as this will cause damage to the retainer, shaft and impeller.

For threaded shaft models

Remove cotter pin and turn castellated nut in counterclockwise direction. Remove washer's and impeller.

For both models

1. Rotate the backplate until the backplate pins clear the pins in the adapter and remove the backplate.
2. Remove the casing gasket.

Note: Protect the sealing surface of the backplate against nicks and scratches while removing, cleaning and reassembling.

3. Remove the carbon seal, o-ring seal, seal cup, and spring.

DG/FG CLAMPED IN SEAT

1. Remove four bolt/screws from backplate. Inspect DG seat insert, gland ring, and gaskets for damage or wear, and replace as required.

Note: #80P outboard and #80R inboard gaskets are NOT INTERCHANGEABLE. #80R (thicker) gasket MUST be inboard-between backplate and seal seat. Care must be taken to protect the sealing face of the backplate for D and F seals and the seal seat for DG seals from nicks and scratches.

2. Remove the carbon seal and o-ring seal. Examine and replace as necessary.

MAINTENANCE

REPAIR

It is recommended that periodic inspection of all parts of the pump be made to prevent malfunctions caused by worn or broken parts. Disassembly for repair is the same procedure as for cleaning.

Note: Protect the sealing surface of the backplate against nicks and scratches while removing, cleaning and reassembling.

1. For D and F seals, examine the backplate sealing surface carefully for any defects that will shorten seal life.
2. Remove the carbon seal, o-ring seal, cup and spring. Remove the drive collar by loosening set screws and sliding collar off the stub shaft.
3. The balanced seal is designed for outside application. Sealing of the process fluid along the shaft is accomplished by action of the process pressure on an o-ring seal installed in a groove in the carbon seal. The same action pressurizes the o-ring groove and augments the spring tension in keeping a tight joint at the sealing faces. The location or width of the sealing face controls the balancing of the seal.
4. Carefully inspect the o-ring seal and carbon seal for signs of abrasions, cuts or other wear that would cause leakage. When the extension of the carbon seal face extends less than $^{1}/_{32}$" from the body, it is advisable that the carbon seal be replaced.
5. Remove the cascading water attachment if included. Remove the rubber shaft deflector by prying it gently from the rear, while sliding it forward. Examine the deflector for tearing, loose fit, or other defects that would allow fluid leakage into the motor along the armature shaft.
6. Remove the bolts securing the adapter to the motor frame and remove the adapter. Loosen the 4 set screws securing the stub shaft to the motor armature. Remove the stub shaft by prying from the back with a flat bar. The stub shaft is a tight fit but can be removed by evenly applying pressure around the periphery of the shaft with the pry bar.
7. Examine the stub shaft sealing surface for nicks or scratches which can cause excessive o-ring seal wear or leaking.
8. Attach a hoist to the motor if necessary, and remove the bolts securing the motor to the adjusting leg brackets. Remove the set screws securing the adjustable legs and remove the legs.

Note: The metal displaced by the set screws on the adjustable legs makes it necessary to tap the legs out with a soft hammer. Rough spots should be filed down prior to reassembly.

9. Inspect casing clamp for damage or wear and replace as required. Inspect the adjusting legs, adjusting leg brackets, adapter and casing and replace if necessary. Motor maintenance, repair and wiring are not covered in this manual. For specific information contact the motor manufacturer.

MAINTENANCE

REASSEMBLY

1. Assemble the adjusting legs to the adjusting leg brackets, and assemble the brackets to the motor. Level the motor by individually adjusting the legs and locking them in place with the set screws.
2. Install the adapter to the motor, with the drain cavity at the bottom. Insert the four bolts securing the adapter to the motor. Tighten the bolts securely.
3. Assemble the stub shaft to the motor armature shaft. Do not tighten set screws.
4. Install the backplate by rotating it until the pins in the backplate engage the pins in the adapter bracket.

For floating retainer models

Rotate the shaft until the floating pin hole is in a horizontal position. Insert the floating retainer, center it in the shaft, and slide the impeller on the shaft. Hold the impeller tight against the shoulder on the shaft and rotate the shaft one-fourth turn until the floating retainer drops and engages the impeller.

For threaded shaft models

Slide the impeller on the shaft and replace washer and castellated nut and cotter pin.

For both models

1. Assemble the clamp to the adapter, and install the casing.
2. Push the stub shaft onto the motor shaft until the impeller strikes the inside front face of the backplate. Locate the stub shaft on the motor shaft allowing $^{1}/_{16}$" (1.5mm) maximum clearance between the rear face of the impeller and the inside face of the backplate. Tighten the four set screws on the stub shaft. Remove casing, impeller, impeller pin and backplate.
3. Slide the rubber deflector on the shaft until it seats the groove in the shaft.

Note: If the deflector cannot be forced on with the fingers, a blunt instrument can be used to provide additional force at the I. D. of the deflector.

4. Slide drive collar onto stub shaft, and locate per setting instructions in next section. Assemble the spring, seal cup, o-ring seal and carbon seal, and install as a unit, taking care that slot in seal cup is aligned with pin in drive collar. Gentle finger pressure will overcome o-ring resistance on the shaft.

Note: Do not lubricate seal with any type of oil or grease. The seal faces are lubricated by product being pumped.

For floating retainer models

Install the backplate by rotating it until the pins in the backplate engage the pins in the adapter. Rotate the shaft until the floating pin hole is in a horizontal position. Insert the floating retainer, center it in the shaft, and slide the impeller on the shaft. Hold the impeller tight against the shoulder on the shaft and rotate the shaft one-fourth turn until the floating retainer drops and engages the impeller.

For threaded shaft models

Install the backplate by rotating it until the pins in the backplate engage the pins in the adapter. Slide the impeller on the shaft. Install washer's and thread the castellated nut to the shaft in a clockwise direction until impeller hub contacts shaft shoulder. Use a combination of washers if needed to ensure that the castellated nut is tight on the impeller before inserting and securing cotter pin.

For both models

1. Install gasket on backplate.
2. Place the casing in position and close and tighten the clamp while lightly tapping the clamp with a hammer to ensure even tightening. Assemble seal guard and tighten nut.
3. Assemble the cascading water attachment, if so equipped, to the adapter. Close and tighten the clamp. Assemble the suction and discharge piping to the pump. Check for strain on the casing. Adjust as necessary.

EXTERNAL BALANCED SEALS - SETTING SEAL DRIVE COLLAR LOCATION

The balanced seal is designed for outside applications, and is available with cascading water attachment. Sealing of the process fluid along the shaft is accomplished by action of the process pressure on an o-ring seal installed in a groove in the carbon seal. The same action pressurizes the o-ring groove and augments the spring tension in keeping a tight joint at the sealing faces. The width of the seal face controls balancing of the seal. This type of seal should be replaced when the clearance between the carbon seal face and the backplate is less the $^{1}/_{32}$" (.79mm), or when leakage is noted.

To replace the seal:

1. Disconnect the suction and discharge piping, and remove the casing, impeller and backplate.
2. Assemble the spring, seal cup, o-ring seal and carbon seal, and install as a unit, taking care that slot in seal cup is aligned with pin on drive collar. Gentle finger pressure will overcome o-ring resistance on the shaft.

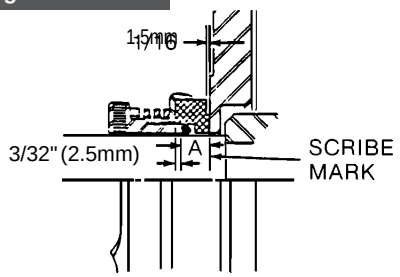
When the carbon seal is replaced, the location of the drive collar should be checked and relocated if necessary, by one of the two following methods.

MAINTENANCE

Setting the Drive Collar by Measurement

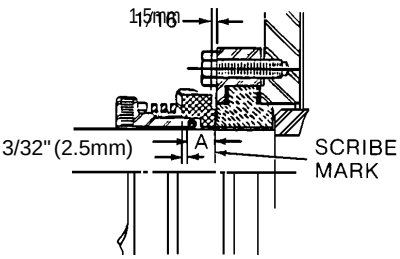
1. Install the backplate, gasket and casing.
2. Install and tighten casing clamp.
3. At a location behind the backplate scribe a mark on the shaft. See Figure 2 or 3.
4. Remove casing clamp, casing, & backplate.
5. Slide the drive collar onto the shaft.
6. Locate drive collar in relation to the scribe mark as shown in dimension A and secure to the shaft with the set screws. Drive collar location is critical.
7. Install the seal spring, seal cups, seal o-ring and carbon onto the shaft.

Figure Two



D/F Seals

Figure Three



DG/FG Seals

SETTING THE DRIVE COLLAR BY POSITION

1. Assemble the spring, seal cup, o-ring seal, and carbon seal onto the drive collar. Care must be taken so that the spring does not rest on the tab that is bent back. A portion of the spring is offset to provide clearance for this tab. Care must be taken to ensure that pin on drive collar is in line with slot on cup.
2. Install as a unit on the shaft.
3. Install the backplate and casing.
4. Install and tighten the casing clamp.
5. Slide the drive collar and seal assembly toward the backplate until the nose of the drive collar pushes the o-ring and carbon seal tight against the backplate.

Model	"A" Dimension
C114	11/32" (2.3mm)
C216	11/32" (2.3mm)
C218	11/32" (2.3mm)
C328	11/32" (2.3mm)
C4410	11/32" (2.3mm)

6. Slide the drive collar away from the backplate 1/32" (.79mm) and secure the drive collar in this location with the set screws.

Note: Extra care should be taken when assembling “C" series pumps with type DG or FG seals. Incorrect stub shaft settings will allow the impeller hub to contact the inboard face of the stationary seal seat. Interference of impeller hub and seal seat face will cause wear of impeller hub and damage the inboard or secondary seal face of the clamped-in-seat. Visual inspection is recommended after installation of the impeller, and before installation of casing, to ensure clearance between the impeller hub and seal face. If no clearance is visible, the pump should be disassembled and stub shaft moved forward, to provide at least 1/32" (.79mm) clearance between the impeller hub and seal seat face. Reset seal drive collar if necessary.

7. When the drive collar is properly positioned and seal components are properly installed, the pump shaft should rotate freely by hand. If excessive effort is required to rotate the shaft, check to be sure that all components are properly installed and the drive collar is properly positioned.

MAINTENANCE

TYPE E WATER COOLED BALANCED DOUBLE SEAL

DISASSEMBLY, CLEANING (GENERAL)

⚠ WARNING

WARNING: Before servicing pump disconnect electrical power source, carefully relieve all pressure and drain all fluids from pump and connected piping.

It is necessary to disassemble parts of the pump for cleaning and sanitizing.

The extent of disassembly will depend on the application, and the type of seal used in your pump. To disassemble, disconnect the suction and discharge piping. Remove seal guard assembly with wrench of appropriate size. Turn the wing nut on the clamp assembly until tension on the clamp saddle is relieved. Open the saddles and remove the casing. At this point the disassembly varies depending on the impeller retaining system applicable to your pump.

For floating retainer models

Push back on the impeller and center the retainer in the stub shaft. Slide the impeller forward and remove it.

For threaded shaft models

Remove cotter pin and turn castellated nut in counterclockwise direction, and remove washer and impeller.

For both models

Disconnect the water inlet and outlet from the stuffing box. Remove the four screws that retain the follower to the stuffing box. Slide the stuffing box and backplate assembly forward off of the stub shaft. Remove the inboard carbon seal, seal o-ring, cup and the seal spring from the shaft. Loosen the two set screws and remove the drive collar. The remaining carbon seal, seal o-ring, cup and the follower may now be removed from the shaft.

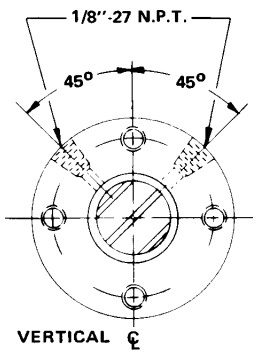
MAINTENANCE

REPAIR

It is recommended that periodic inspection of all parts of the pump be made to prevent malfunctions caused by worn or broken parts. Disassembly for repair is the same procedure as for cleaning. This seal design is used in applications where a vacuum tight, cool operating seal is required. This seal consists of two carbon seals inside a stuffing box, which is attached to the backplate. Its sealing action is the same as the external balanced seal.

1. WATER MUST BE PIPED THROUGH THE STUFFING BOX TO KEEP THE SEAL COOL AND VACUUM TIGHT. The amount of water used will vary depending on the operating temperature of the pump. In vacuum applications 10 drops per minute discharge is recommended, while approximately 3 gallons per hour is required to maintain seal temperature at 100°F (38°C) when the product temperature is 175°F (79°C).
2. Two $^{1}/_{8}$" NPT water connections are provided on the stuffing box. They are spaced at 90° from each other, and should be located when assembling the pump so that they are at 45° to vertical. Flush water must enter one of these connections and exit through the other connection. Refer to figure 4.
3. Carefully inspect the o-ring seals and the carbon seals for signs of abrasions, cuts or other wear that would cause leakage. When the extension of the carbon seal face extends less than $^{1}/_{32}$" from the body, it is advisable that the carbon seal be replaced. Inspect backplate seal surface and follower seal surface for nicks or scratches. Replace if necessary.

Figure Four



E Seal

4. Remove the rubber shaft deflector by prying it gently from the rear, while sliding it forward. Examine the deflector for tearing, loose fit, or other defects that would allow fluid leakage into the motor along the armature shaft.
5. Remove the bolts securing the adapter to the motor frame and remove the adapter. Loosen the 4 set screws securing the stub shaft by prying from the back with a flat bar. The stub shaft is a tight fit but can be removed by evenly applying pressure around the periphery of the shaft with the pry bar.
6. Examine the stub shaft sealing surfaces for nicks or scratches which can cause excessive o-ring seal wear or leaking.
7. Attach a hoist to the motor if necessary, and remove the bolts securing the motor to the adjusting leg brackets. Remove the set screws securing the adjustable legs and remove the legs.

Note: The metal displaced by the setscrews on the adjustable legs makes it necessary to tap the legs out with soft hammer. Rough spots should be filed down prior to reassembly.

8. Inspect casing clamp for damage or wear, and replace as required. Inspect the adjusting legs, adjusting leg brackets, adapter and casing and replace if necessary.
9. Motor maintenance, repair and wiring are not covered in this manual. For specific information contact the motor manufacturer.

REASSEMBLY

1. Assemble the adjusting legs to the adjusting leg brackets, and assemble the brackets to the motor. Level the motor by individually adjusting the legs and locking them in place with set screws.
2. Install the adapter to the motor, with the drain cavity at the bottom. Insert the four bolts securing the adapter to the motor. Tighten the bolts securely.

3. Assemble the stub shaft to the motor armature shaft. Do not tighten set screws.
4. Install the backplate into the counter-bore in the adapter.

For floating retainer models

Rotate the shaft until the floating pin hole is in a horizontal position. Insert the floating retainer, center it in the shaft, and slide the impeller on the shaft. Hold the impeller tight against the shoulder on the shaft and rotate the shaft one-fourth turn until the floating retainer drops and engages the impeller.

For threaded shaft models

Slide the impeller on the shaft and replace washer and castellated nut and cotter pin. Use a combination of washers if needed to ensure that the castellated nut is tight on the impeller before inserting and securing cotter pin.

For both models

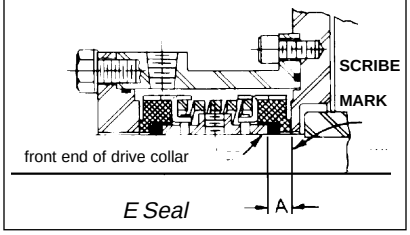
1. Assemble the clamp to the adapter, and install the casing.
2. Push the stub shaft onto the motor shaft until the impeller strikes the inside front face of the backplate. Locate the stub shaft on the motor shaft allowing $^{1}/_{16}$" (1.5mm) maximum clearance between the rear face of the impeller and the inside face of the backplate. Tighten the four set screws on the stub shaft. At a location behind the backplate, scribe a mark on the shaft (refer to Figure 5). This will be required to set the drive collar location as described in this section.
3. Remove casing, impeller and backplate.
4. Slide the rubber deflector on the shaft until it seats the groove in the shaft.

Note: If the deflector cannot be forced on with the fingers, a blunt instrument can be used to provide additional force at the I.D. of the deflector.

5. Slide the follower, one carbon seal, one seal o-ring, one seal cup, and drive collar onto the shaft.

Figure Five

Drive Collar Setting



Model	"A" Dimension
114	$^{11}/_{32}$" (2.3mm)
216	$^{11}/_{32}$" (2.3mm)
218	$^{11}/_{32}$" (2.3mm)
328	$^{11}/_{32}$" (2.3mm)
4410	$^{11}/_{32}$" (2.3mm)

6. Locate drive collar in relation to scribe mark as shown in Figure 5 and secure to the shaft with the set screws. Drive collar location is critical.
7. Install the seal spring, seal cup, seal o-ring and carbon onto the shaft. Be sure the spring is seated in each cup and the drive ear on each seal cup is not in alignment with the drive pins on the drive collar.
8. Slide the stuffing box and backplate assembly over the shaft and seal parts.
9. Secure the follower to the stuffing box using four screws.
10. Assemble the backplate, the impeller, and the casing to the pump and tighten clamp, tapping with soft hammer. (Make sure the orientation of the water connection on the stuffing box is correct Figure 5).
11. Assemble seal guard and tighten nut.
12. Connect the water inlet and outlet piping to the stuffing box.
13. Assemble the suction and discharge piping to the pump.
14. Check for strain on the casing. Adjust as required.

STUB SHAFT ON MODEL CC4410 PUMPS

INSTALLATION

If you purchased a MODEL C4410 pump LESS MOTOR, and are installing your own motor, or if you are CHANGING MOTORS, please note following special instructions for proper assembly:

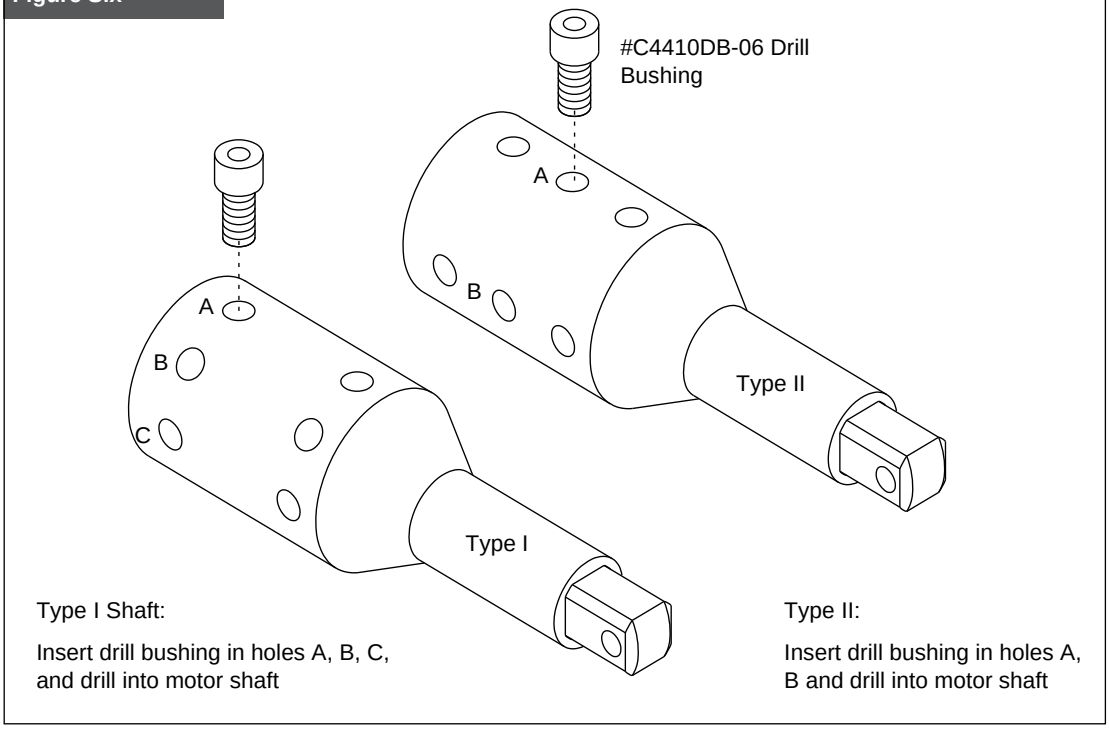
C4410 pump shafts utilize six set screws to secure the stub shaft to the motor shaft. Because some of these six set screws are of the "dog point" design, it is necessary to drill "F" (.257) diameter holes - $^{3}/_{16}$" (5mm) deep into the motor shaft when assembling the pump.

C4410 pumps manufactured between December 1988 and June 1989 feature stub shafts designated as Type I on illustration below (Figure 6). Three of the six set screws on Type I shafts are "dog point", and must be installed as noted above. C4410 pumps manufactured after June 1989 feature stub shafts designated as Type II on illustration below. Two of the six set screws on Type II shafts are "dog point", and must be installed as noted above.

These holes must be drilled AFTER the stub shaft is properly located on the motor shaft. Proper location is with $^{1}/_{16}$" (1.5mm) clearance between the impeller back-face and the inside face of the backplate. Holes are drilled into the motor shaft in line with the set screw holes of the stub shaft.

DRILL BUSHING #C4410DB-06 should be used when drilling the holes, to assure correct placement. Effective 4/1/89, one #C4410DB-06 Bushing is included with each C4410 pump shipped from Tri-Clover LESS MOTOR. Additional bushings are available upon request from Tri-Clover, if you require for later field servicing of the pump.

Figure Six



Type I Shaft:

Insert drill bushing in holes A, B, C, and drill into motor shaft

Type II:

Insert drill bushing in holes A, B and drill into motor shaft

TROUBLESHOOTING

TROUBLESHOOTING GUIDELINES

Tri-Clover pumps are relatively maintenance free with the exception of sanitizing. Like any piece of machinery, however, occasional problems can arise. This section provides a means of determining and correcting most of your pump problems. The motor manufacturer should be contacted for specific repair instructions on the motor.

The chart below has been prepared on the basis that the pump is properly suited to its application. Should problems arise where the remedies listed below chart do not cure the situation, pump cavitation may be the problem. Symptoms of pump cavitation, such as noisy operation, insufficient discharge and vibration, can result when a pump is not properly applied. If these conditions are present, check the system and re-evaluate the application. If assistance is required, contact Tri-Clover.

PROBLEM	PROBABLE CAUSE	REMEDY
1. No discharge.	a. Pump speed too low.	a. Correct wrong or poor electrical connections.
	b. Wrong direction of rotation.	b. Reverse a three-phase motor by switching any two of the three power leads at the motor controller; reverse a single phase motor per motor manufacturer's instructions.
	c. Closed valve; obstruction in discharge piping.	c. Open gate valve; clear obstruction.
2. Insufficient discharge.	a. Pump speed too low.	a. See 1a above.
	b. Wrong direction of rotation.	b. See 1b above.
	c. Valve partially closed; obstruction in discharge piping.	c. See 1c above.
	d. Impeller damaged.	d. Replace impeller.
3. Excessive power consumption.	a. Motor speed too high.	a. Internal motor wiring is incorrect; replace motor.
	b. Impeller is binding.	b. Relieve strain on casing replace defective impeller.
	c. Motor shaft is bent or worn.	c. Replace shaft.
4. Pump is noisy.	a. Magnetic hum in motor.	a. Consult motor manufacturer.
	b. Motor bearings are worn.	b. Replace bearings.
	c. Foreign matter is rotating with impeller.	c. Remove casing and remove foreign matter.
	d. Impeller is binding.	d. See 3b above.
	e. Cavitation	e. Improper sizing or piping, etc.
5. Excessive vibration.	a. Pump is not leveled properly.	a. Level pump.
	b. Impeller is damaged.	b. Replace impeller.
	c. Piping is not supported.	c. Support discharge and suction piping.
	d. Cavitation	d. Improper sizing or piping, etc.
6. Pump leaks.	a. O-ring seal is worn or defective.	a. Replace o-ring seal.
	b. Carbon seal is worn.	b. Replace carbon seal.
	c. Insufficient compression on seal assembly.	c. Replace spring.
	d. Damaged inlet or outlet.	d. Replace casing.
	e. Backplate gasket is worn.	e. Replace gasket.
	f. Clamp is loose.	f. Tighten clamp.

Click here to Order Parts

PARTS LIST

All orders for repair parts must contain the following data.

1. Complete model number (located on nameplate).
2. Pump serial number (located on nameplate).
3. Description and part key number from the parts list.

The exploded views and accompanying parts list facilitate ordering repair parts from the factory. All parts of the pump are exploded and keyed to the parts list.

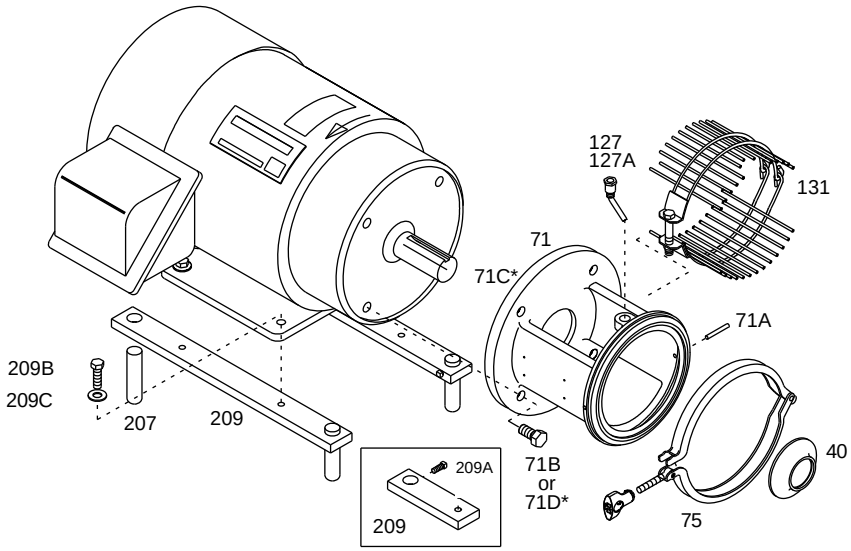
KEY	DESCRIPTION	QTY
1	Casing	1
2	Impeller	1
6A	Set Screw (Shaft)	4
6D	Universal Stub Shaft-Threaded	1
6E	Universal Stub Shaft-STD	1
11	Backplate	1
11B	Backplate	1
11F	Backplate Pin	2
11H	Backplate (DG)	1
17	Follower	1
17A	Machine Screw	4
17B	O-ring	1
17C	Lockwasher	4
17J	SS Gland Ring (DG)	1
17K	Bolt/Screw (DG)	4
17M	Lockwasher (DG)	4**
24	Retainer (Impeller)	1
24A	Castellated Nut (Impeller)	1
24B	Cotter Pin (Impeller)	1
40	Deflector	1
71	Adapter	1
71A	Adapter Pin	2
71B	Adapter Mounting Screw	4
71C	Adapter Plate (See note next page)	1
71D	Adapter Mounting Screw- (Used only with #71C above)	4
75	Clamp Assembly Complete	1

KEY	DESCRIPTION	QTY
80	Carbon Seal	1 or 2*
80A	Cup	1
80B	O-ring (Seal)	1 or 2*
80C	Spring	1
80G	Cup	2
80H	Spring	1
80J	Drive Collar	1
80K	Set Screw	2
80L	Drive Collar	1
80M	Set Screw-Drive Collar	2
80N	Seal Seat (DG)	1
80P	PTFE Gaskets (DG)	1 or 2**
80R	PTFE Gaskets (DG)	1**
83C	Stuffing Box	1
83D	Machine Screw	4
83E	O-ring	1
90	Casing Gasket	1
127	Water Inlet Assembly	1
127A	Lock Nut	1
131	Seal Guard Assembly	1
133	Washer (Impeller)	1
207	Adjustable Leg	4
209	Adjustable Leg Bracket	2
209A	Set Screw (Square Hd.)	4
209B	Bracket Mounting Screw	4
209C	Washer (Leg Assembly)	4

* E Seal takes 2.

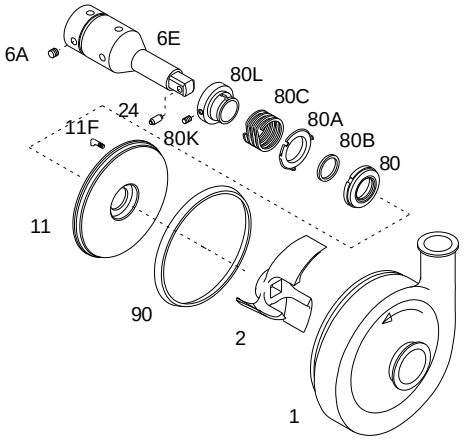
** Model 114/216/218/328 req. 1-#80P outboard gasket ($^1/_{16}$" thick), and 1-#80R inboard gasket ($^1/_8$" thick). Gaskets are not interchangeable.
Model 4410 req.
2-#80P gaskets (same size out/inboard). All models req. 4-#17M lockwashers.

For All C Series Pumps

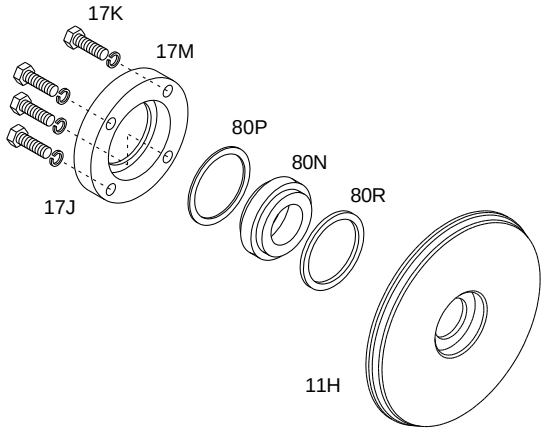


Note:* Depending on type of frame, some older models C114 and 216 with type E seals require a special adapter #71C, and longer mounting screws, #71D.

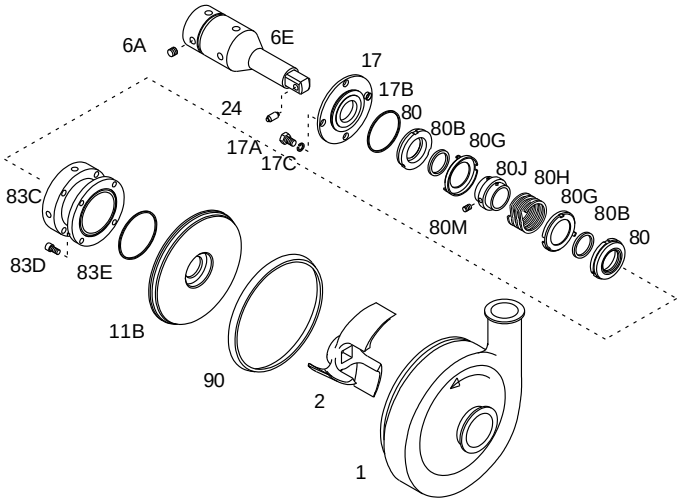
Floating Retainer with Type D or F External Balanced Seals



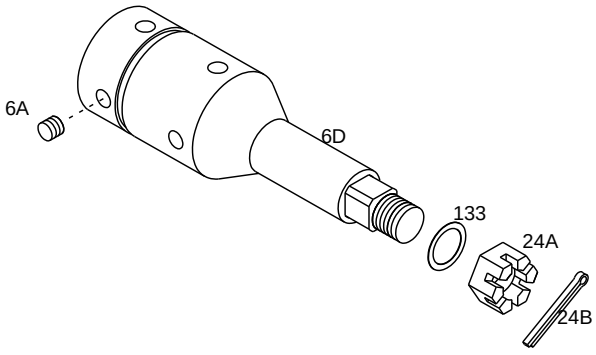
Additional Type "DG" Clamped-in Seal Seat Components (For use with type D seal)



Floating Retainer with Type E Water Cooled Balanced Double Seal



Threaded Shaft and Castellated Nut Retainer System for Use with Type D, F or E Seals



C-SERIES CLOSE COUPLED PUMP

		C114	C216	C218	C328	C4410
Key No.	Description	Part Number	Part Number	Part Number	Part Number	Part Number
1	Casing (Tri-Clamp) Sanitary	S114M-01C-316L	S216M-01C-316L	S218M-01D-316L	S328M-01C-316L	SP4410M-01A-316L
1	Casing (Bevel Seat) Sanitary	S114T-01C-316L	S216T-01C-316L	S218T-01D-316L	S328T-01C-316	SP4410T-01A-316
1	Casing (N.P.T.) Glass Beaded	S114S-01C-316L	S216S-01C-316L	S218S-01D-316L	S328S-01C-316	SP4410S-01A-316
1	Casing (Tri-Clamp) Glass Beaded	S114MI-01C-316L	S216MI-01C-316	S218MI-01D-316	S328MI-01C-316	SP4410MI-01A-316
1	Casing (Bevel Seat) Glass Beaded	S114TI-01C-316L	S216TI-01C-316	S218TI-01D-316	S328TI-01C-316	SP4410TI-01A-316
1	Casing (Flanged) Glass Beaded	S114F-01D-316L	S216F-01D-316L	S218F-01E-316L	S328F-01D-316L	SP4410F-01B-316
2	Impeller	S114-02C-316L	S216-02C-316L	S218-02C-316L	S328-02C-316	SP5410-02A-316
11	Backplate	114D-11-316	216D-11-316	328D-11-316	328D-11-316	4410D-11-316
11B	Backplate (E Balanced)	114E-11B-316	216E-11B-316	328E-11B-316	328E-11B-316	4410E-11-316
11F	Backplate Pin	216D-11-1-S	216D-11-1-S	216D-11-1-S	216D-11-1-S	SC1108D-M
11H	Backplate (DG Seat)	SP114G-11-316L	SP216G-11-316L	328G-11-316	328G-11-316	4410G-11-316
17	Follower	114E-17A-316	216E-17A-316	328E-17-316	328E-17-316	4410E-17-316
17A	Machine Screw	SC1106E-SS	SC1308H-SS	SC1308H-SS	SC1308H-SS	SC1308H-SS
17B	O-ring	17-106-U-25**	17-275-U	17-274-U	17-274-U	17-108-U-25**
17C	Lockwasher (DG Seat)	---	LWA1300-SS	LWA1300-SS	LWA1300-SS	LWA1300-SS
17J	Gland Ring (DG Seat)	SP114G-17-316L	SP216G-17-316L	SP328G-17-316L	SP328G-17-316L	4410-G-17-316L
17K	Bolt / Screw (DG Seat)	SC1110H-SS	SC1310H-SS	SC1311H-SS	SC1311H-SS	SC1311H-SS
17M	Lockwasher	LWA-1100-SS	LWA-1300-SS	LWA-1300-SS	LWA-1300-SS	LWA-1300-SS
24	Impeller Retainer	114D-24B-316L	216D-24B-316L	328D-24B-316L	328D-24B-316L	328D-24C-U
24A	Castellated Nut (Impeller)	SP114F-24-316	SP216F-24-316L	SP328F-24-316	SP328F-24-316	SP328F-24-316
24B	Cotter Pin (Impeller)	16-113-1/8X1-316	16-113-1/8X1-316	16-113-1/8X1½-316	16-113-1/8X2-316	16-113-1/8X2-316
71A	Adapter Pin	216D-71A-1-S	216D-71A-1-S	216D-71A-1-S	216D-71A-1-S	SP5410-11A-1-S
75	Clamp Assembly Complete	S114-75AR-S	S216-75AR-S	S328-75AR-S	S328-75AR-S	SP4410-75D-S
75J	Eye Bolt	S114-75A-04-S	S114-75A-04-S	S114-75A-04-S	S114-75A-04-S	---
75K	Wing Nut	13MHHS-1½-03-S	13MHHS-1½-03-S	13MHHS-1½-03-S	13MHHS-1½-03-S	---
80	Carbon Seal	114E-80-1A	216E-80-1A	328E-80-1A	328E-80-1A	4410E-80-1
80A	Cup	114D-80-3P	216D-80-3P	328D-80-3P	328D-80-3P	4410D-80-3
80B	O-ring (Seal)	60C-3-34A-U	01-1165-19-U	S328-80-2-U	S328-80-2-U	17-15-U
80C	Spring	114D-80-4	216D-80-4	328D-80-4	328D-80-4	4410D-80-4
80G	Cup (E Balanced)	114E-80-3P	216E-80-3P	328E-80-3P	328E-80-3P	4410E-80-3
80H	Spring (E Balanced)	114E-80-4A	216E-80-4A	328E-80-4A	328E-80-4A	4410E-80-4

VARIABLE REPLACEMENT PARTS

Model C114

		56C NEMA Frames	180TC NEMA Frames	140TC NEMA Frames
Key No.	Description	Part Number	Part Number	Part Number
6A	Set Screw (shaft)	SC1305A-SS	SC1303A-SS	SC1303A-SS
6D	Shaft-Threaded	C114E56TT-06-316L	C114E18TT-06-316L	C114E14TT-06-316L
6E	Shaft-Standard	C114E56T-06-316L	C114E-18T-06-316L	C114E14T-06-316L
40	Deflector	US114D66-40-U	114D18T-40	US114D66-40-U
71	Adapter	114E56T-71C-C	114E-18T-71C-C	114E56T-71C-C
71B	Adapter Mounting Screw	SC1512H-SS	SC1710H-SS	SC1510H-SS
131	Seal Guard Assembly	C114-56T-131A-S	C114-18T-131A-S	C114-56T-131A-S
207	Adjustable Leg	114D-207-CS	114D-207-CS	114D-207-CS
209	Adjustable Leg Bracket	114D56T-209A-CS	114D184T-209A-CS	114D145T-209-CS
209A	Set Screw (Square Head)	SC1106C4-SS	SC1107C4-SS	SC1106C4-SS
209B	Bracket Mounting Screw	SC1307H-SS	SC1510H-SS	SC1307H-SS
209C	Washer	WA1300-SS	WA1500-SS	WA1300-SS

Model C216

		56C NEMA Frames	180TC NEMA Frames	210TC NEMA Frames	250TC NEMA Frames	140TC NEMA Frames
Key No.	Description	Part Number	Part Number	Part Number	Part Number	Part Number
6A	Set Screw (shaft)	SC1505A-SS	SC1303A-SS	SC1504A-SS	SC1504A-SS	SC1504A-SS
6D	Shaft-Threaded	216E56TT-06A-316L	216E18TT-06A-316L	C216E21TT-06-316L	C216E25TT-06-316L	216E-14TT-06A-316L
6E	Shaft-Standard	CS216E56T-06-316L	CS216E-18T-06-316L	C216E21T-06-316L	C216E25T-06-316L	CS216E14T-06-316L
40	Deflector	216D21-40	216D21-40	216D21T-40-U	328D28-40	216D21-40
71	Adapter	216D56T-71D-C	216D18T-71D-C	216E21T-71D-C	216E25T-71D-C	216D56T-71D-C
71B	Adapter Mounting Screw	SC1510H-S	SC1710H-SS	SC1710H-SS	SC1710H-S	SC1510H-S
131	Seal Guard Assembly	C216-56T-131-S	C216-18T-131-S	C216-21T-131B-S	C216-21T-131B-S	C216-56T-131-S
207	Adjustable Leg	114D-207-CS	114D-207-CS	114D-207-CS	216D-207-CS	114D-207-CS
209	Adjustable Leg Bracket	114D56T-209A-CS	114D184T-209A-CS	216D215T-209A-CS	216D256T-209A-CS	114D145T-209-CS
209A	Set Screw (Square Head)	SC1106C4-SS	SC1107C4-SS	SC1107C4-SS	SC1107C4-SS	SC1106C4-SS
209B	Bracket Mounting Screw	SC1307H-SS	SC1512H-SS	SC1512H-SS	SC1714H-SS	SC1307H-SS
209C	Washer	WA1300-SS	WA1500-SS	WA1500-SS	WA1500-SS	WA1300-SS

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Tri-Clover Inc.

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Tri-Clover Canada
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Scarborough, Ontario M1S4S6
PHONE: 416-297-3400
FAX: 416-299-5095

Export Division
PHONE: +1-414-697-3170
FAX: +1-414-694-8188

Tri-Clover Mexico
Recursos Petroleros No. 7
Fracc. Ind. La Loma
54060 Tlalnepantla, Edo. de Mexico
PHONE: 52-5-397-0601
FAX: 52-5-362-3246

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